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# On the consistency of hedge fund indexes across providers

Oliver Dietiker\*

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## Abstract

Based on the style analysis pioneered in [Sharpe, W.F. (1992). Asset Allocation: Management Style and Performance Measurement, *Journal of Portfolio Management*, 7-19.] I define a procedure to examine the consistency of hedge fund indexes across providers. The results of my investigation suggest that the competing indexes of the different providers are homogeneous. However, I also find two cases for which one provider differently allocates the funds between styles compared to its peers.

## Introduction

A hedge fund (HF) is a collective investment scheme that is subject to a low level of regulation.<sup>1</sup> As a consequence of the low regulatory supervision, HF managers are not allowed to publicly advertise their funds and, more importantly, HF managers do not have to disclose their investment policies and performance data on a regularly basis. But due to the growing attention the HFs have attracted in recent years such information has become a valuable good both for academic researchers and practitioners. Not surprisingly, trading with HF data has grown into a lucrative business: several companies gather, process and sell data on HFs. Access to individual fund data is usually quite costly, however, these data providers advertise their databases by providing various collective index data that can be accessed without charge. In most cases, a broad HF index and several style indexes are published. A style index represents the performance of a subset of all HFs that follow similar strategies.

The main purpose of the present study is to investigate if the style indexes published by the different HF data providers yield a homogenous picture in the sense that they exhibit similar exposure to so-called factor strategies. A factor strategy is a zero-investment strategy that proxies for investments in a

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<sup>1</sup>See Fung and Hsieh (1999) and or Ackermann et al. (1999).

specific asset class or geographic region, and its construction relies solely on publicly available information. The decomposition of the returns of actively managed portfolios into factor strategies has been pioneered in Sharpe (1992) for analyzing an extensive sample of US mutual funds. Based on Sharpe's approach I define a procedure for analyzing the consistency of index returns across providers. The procedure involves the evaluation of the best four-factor model for each competing index representing a specific style and the selection of the factor strategy that predominantly appear in these models. I refer to such factor strategies as dominant factors.

There are several well-documented problems that can lead to strong differences between HF indexes published by different providers. First, the reporting of the HFs to the index providers is on a purely voluntarily basis. Most HF managers do not report at all or only choose to report to their preferred database.<sup>2</sup> Hence the datasets on which the indexes are based strongly differ across providers. Second, eventhough there is a vague consensus about the different HF styles, every company applies an individual definition and allocation scheme. Finally, the calculation of the indexes is not consistent across providers. While most providers construct their indexes as an equally weighted average of the funds assigned to a certain style, the Credit-Suisse/Tremont indexes are calculated based on the market capitalization of the funds, and the Center for International Securities and Derivatives Markets (CISDM) reports the medians of their samples.

The results of my investigation suggest that the competing indexes of the different providers are homogenous. I find three or four dominant factors for most styles. Moreover, the exposure to these factors is usually within the same range, and in several cases equality cannot be rejected. As counterexamples I find two cases for which one provider differently allocates the funds between styles compared to its peers. Additionally, I find evidence that there is a different investment focus for large and small funds for three styles.

The present study is related to Amenc and Martellini (2002) which compare the style indices of several HF providers using Kalman filter and principal component analysis (PCA).<sup>3</sup> However, they follow a purely statistical approach while I focus in the decomposition of HF styles in investable factor strategies, thereby seeking economic significance. My analysis is also related to Cappocio and Hübner (2001) and Argawal and Naik (2004). In this case, the relation is in terms of procedure rather than intention. These studies use linear factor models for analyzing HF risk exposure and return. Eventhough these studies do not intend to compare indexes across providers, their results can serve as a reference for my findings.

The remainder of this study is organized as follows. Section 2 describes the procedure applied in this study. The data is presented in Section 3. The main results are given in Section 4. In Section 5 the results of two robustness tests are presented. Section 6 concludes.

<sup>2</sup>See Amenc and Martellini (2002).

<sup>3</sup>Several other studies also rely on PCA to analyze the dominant factors of a hedge funds styles, e.g. Fung and Hsieh (1997).

## Procedure

Let  $R_t$  be the excess return of a financial asset which can be represented by a linear combination of factors  $F_{i,t}$  :

$$R_t = \alpha + \sum_{i=1}^k \beta_i F_{i,t} + \varepsilon_t, \quad (1)$$

where  $E[\varepsilon_t] = E[\varepsilon_t F_{i,t}] = 0$ , and where  $\alpha, \beta_i$  are constants,  $i = 1, \dots, k$ . Equation (1) holds due to the arbitrariness of  $\varepsilon_t$ . The economic content of in the regression model (1) is given by the interpretation of the right-hand side factors  $F_{i,t}$ . Linear asset pricing models interpret these factors as proxies for economic risk. Exposure to these risk factors, measured by  $\beta_i$ , is rewarded with expected return above the risk-free rate. Mispricing of the model is reflected in the term  $\alpha$ . The most prominent asset pricing model is arguably the Capital Asset Pricing Model (CAPM)<sup>4</sup> which states that only exposure to broad market risk is rewarded, that is, the only factor in (1) is the excess return of the market portfolio. An often cited extension of the CAPM is the Fama French three factor model (FF-model).<sup>5</sup> This model relies on the observation that market capitalization<sup>6</sup> and book-to-market ratio<sup>7</sup> can explain a significant portion of the the cross-sectional difference of stock returns that is not captured by broad market exposure. Testing of the FF-model is carried out by running a regression of the form

$$R_t = \alpha + \beta_1 \text{MKT}_t + \beta_2 \text{SMB}_t + \beta_3 \text{HML}_t + \varepsilon_t, \quad (2)$$

where  $\text{FFM}_t$ ,  $\text{SMB}_t$  and  $\text{HML}_t$  are portfolios proxying for general equity risk ( $\text{FFM}_t$ ), risk assoziated with size ( $\text{SMB}_t$ ) and book-to-market values ( $\text{HML}_t$ ). The construction of these portfolios is simple and only relies on publicly available information<sup>8</sup>:  $\text{FFM}_t$  is a capital weighted portfolio of US stocks, financed with a short position in the risk free rate;  $\text{SMB}_t$  is a portfolio holding long positions in small-capitalized companies, financed with short positions in large companies;  $\text{HML}_t$  is a portfolio holding long positions in companies with high book-to-market ratios, financed with short positions in companies having low book-to-market ratios. Note that all portfolios are zero-investment portfolios.

When considering the returns of a managed portofolio, e.g. of a HF, the linear factor approach (2) has a natural interpretation as decomposing the investment strategy in three basic strategies.<sup>9</sup> I refer to these basic strategies as *factor strategies*. For example, a positive value for  $\beta_2$  in (2) indicates that the porfolio manager preferably chooses small companies. Moreover, a positive  $\alpha$  in the regression models (1-2) is then not to be interpreted as mispricing of the model but can be attributed to the portfolio manager's investment skills.<sup>10</sup>

<sup>4</sup>See Sharpe (1964) and Black (1972).

<sup>5</sup>See Fama and French (1992, 1993, 1995).

<sup>6</sup>See Banz (1981).

<sup>7</sup>See Rosenberg et al. (1985).

<sup>8</sup>See Fama and French (1993) for details.

<sup>9</sup>See Sharpe (1992).

<sup>10</sup>See Jensen (1968).

A HF style describes the basic investment behavior of a subsample of the HF universe. For example, the HF style *distressed securities* refers to HFs which focus on mispricings of companies that are in financial stress. My investigation is based on the hypothesis that a HF style can be decomposed in a typical combination of factor strategies. Further, I claim that the competing indexes of a specific HF style are homogenous if the same factor strategies appear in the factor combination that yields the best explanatory power for the returns. Now, HF managers usually apply dynamic strategies, that is, they vary their exposures to an asset class or switch between classes.<sup>11</sup> The regression framework (1), however, calculates fixed exposure to strategy factors. Hence the results have to be interpreted as a comparison of average exposure for the whole sample period.

In detail, the procedure is conducted as follows. First, I identify a set of possible factor strategies. I use the same set of factor strategies for all HF styles. For each HF style I consider the competing indexes published by the different providers. For each of these indexes I evaluate the combination of four factors that exhibits the best explanatory power in terms of  $R^2$ . The choice to allow *four* factors is motivated by the results in Cappocia and Hübner (2001) which evaluates the performance of different HF styles using linear models with up to eight factors. The results for the eight-factor model show that, depending on the specific style, three to five factors have significant factor loadings. Hence using four factors seems to be a natural choice.

In the next step I compare the factor models yielding the best results (in terms of  $R^2$ ) across providers. If a factor appears in at least all but one combination, then I consider this factor a *dominant factor* for the style under consideration. By construction, findings may vary from zero to four dominant factors for each style. Then I combine these dominant factors to a *dominant factor model* and jointly estimate the parameters of the model for all indexes in a pooled regression. I allow for correlation in the residuals across equations in a model of seemingly unrelated regressions (SUR).<sup>12</sup> Finally, I compare the exposures to the factor strategies across providers. I stress that this procedure is conducted for each style individually.

The results differ in the number of dominant factors across styles. I find two to four dominant factors. To get an idea how these results serve as evidence for consistency across providers I assume that each factor combination evolves equally likely and independently across providers. The least consistent result is obtained for the market neutral style with only two dominant factors. Basic combinatorics yields that this level of consistency is achieved or exceeded with probability of 9% which provides some evidence towards consistency. However, when considering the result that exhibits the second least degree of consistency – short selling indexes agree on three factors – I find that the probability of achieving at least this level of consistency is close to 0%. Hence the existence of

<sup>11</sup>See, e.g. Fund and Hsieh (1997, 2000).

<sup>12</sup>Note that the coefficients estimated by the SUR model are similar to applying OLS regression to each equation individually, see Green (2008). However, the factors are estimated with higher precision which increases the power to detect inequalities in the estimates.

factor strategies yield strong evidence towards consistency across providers for all but one style.

## Description of data

In this section I present the data used in study. I first describe the different HF style indexes in Section 3.1. The factor strategies are introduced in Section 3.2.

### Hedge Fund style indices

I work with HF indices published by the following index providers: Credit-Suisse/Tremont (CST), Hedge Fund Research (HFR), Center for International Securities and Derivatives Markets (CISDM), Altvest, Barclay Hedge (Barclay), Greenwich and HedgeFund.net (HFN). The data for this study was downloaded in August of 2008. I do not consider any changes in strategy definitions and data adaptations that are done at later times. For estimation and statistical tests I analyze data for the period January 1997 to July 2008.

I only consider HF styles for which at least all but one provider publishes a style-index. These strategies are: equity long/short, equity market neutral, short selling, event driven, distressed securities, merger arbitrage, convertible arbitrage, emerging markets and global macro.<sup>13</sup> All data were downloaded from the webpages of these providers (see Table 1).

To get an idea of how the different indexes of the providers are correlated I calculate the average coefficient of linear correlation of the competing indexes of a specific style. The results are reported in Table 2. I find that average linear correlation is around 0.9 for most styles and the broad indexes. For the global macro, market neutral and short selling strategies the average correlation coefficient is considerably lower. The result for the short selling strategies has to be interpreted with care as the Altvest short selling index exhibits significantly negative correlation with all other indexes. When excluding the Altvest index the average correlation for the remaining indexes is 0.90. The average correlation for the indexes representing global macro and market neutral strategies show considerably lower correlation throughout all providers. This result agrees with the findings of Amenc and Martelline (2002) which analyses HF index data for the period January 1998 to December 2000.

### Factor strategies

I simulate broad equity strategies with the returns of the following indices in excess of the 1 month US treasury bill rate: the MSCI World TR index, the MSCI Non-US index and the MSCI Emerging Markets Index. Further, I use the Fama French market factor to proxy for investments in US equities. To account

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<sup>13</sup>A brief description of these index styles is given in the Appendix. Note that distressed securities and merger arbitrage are usually subcategories of the event-driven style.

**Table 1: Providers of HF indices.** This table lists the different providers of HF indices that are considered for the present study. I also denote the webpages of these providers. Note that only factor strategies for which at least all but one providers publish a style index are included. The providers are: Credit-Suisse Tremont (CST), Hedge Fund Research (HFR), Center for International Securities and Derivatives Markets (CISDM), Altvest, Barclay Hedge (Barclay), Greenwich and Hedge Fund Net (HFN). I consider the broad HF index and the following style indexes: equity long/short=LS, short selling=SHORT, market neutral=MKTN, distressed securities=DIS, event driven=ED, merger arbitrage=MA, convertible arbitrage=CA, emerging market=EM, global macro=MACRO.

Provider	Webpage	BROAD	LS	SHORT	MKTN	DIS	ED	MA	CA	EM	MACRO
CST	www.hedgeindex.com	✓	✓	✓	✓	✓	✓	no index	✓	✓	✓
HFR	www.hfr.com	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
CISDM	www.cisdsm.org	✓	✓	no index	✓	✓	✓	✓	✓	✓	✓
Altvest	www.altvest.com	no index	✓	✓	no index	✓	no index	✓	no index	✓	✓
Barclay	www.barclayhedge.com	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Greenwich	www.greenwichai.com	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
HFN	www.hfn.net	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓

**Table 2: Average pairwise correlation.** This table denotes the average pairwise linear correlation coefficients (avg corr) for the competing indexes of each style. Further, the minimum and maximum value for each style is denoted. I consider the broad HF index and the following style indexes: equity long/short=LS, equity short selling=SHORT, equity market neutral=MN, event driven=ED, distressed securities=DIS, convertible arbitrage=CA, merger arbitrage=MA, emerging markets=EM, global macro=MACRO.

	BROAD	LS	SHORT	MKTN	DIS	ED	MA	CA	EM	MACRO
avg corr	0.9122	0.8918	0.4568	0.5829	0.8863	0.9225	0.9111	0.8587	0.9155	0.76
min corr	0.7996	0.6622	-0.5270	0.3073	0.7550	0.85	0.8587	0.8587	0.8171	0.49
max corr	0.9934	0.9845	0.9617	0.8879	0.9615	0.9713	0.9448	0.9808	0.9870	0.9211

**Table 3: Average correlation of strategy factors and HF styles.** This table denotes the average pairwise linear correlation coefficients of the style indexes and the factor strategies. Moreover, for each factor I denote the fraction of competing indexes that exhibit pairwise correlation coefficients that are significantly different from 0 at the 5% level. For example: the long/short equity indexes exhibit, on average, linear correlation 0.76 with the Fama French Market factor (FFM). Further, all seven competing indexes exhibit significant correlation with the FFM factor. To increase the readability of the table I denote the fraction of significant correlation coefficients in bold type. I consider the following strategies: the Fama French market (FFM), size (SMB) and value (HML) factors, the Carhart momentum factor (MOM); the excess returns of the MSCI indexes proxying for investment in global equities (WRLD), non US investments (ExUS) and investments in emerging markets (EM); factor strategies focussing on cash-flow (CF), dividend yield (DY) and price earnings (PE). Further, I consider the excess returns of the following non-equity indexes: Lehman US Aggregate bond (USB), Lehman BAA Corporate bond (BAA), Lehman Global bond (GB), JP Morgan emerging markets bond (EMB) and the S&P commodity index. Finally, the CBOE strategies PutWrite (PUT) and S&P 500 Collar (CLL) are considered to account for strategies that incorporate options. I consider the broad HF index and the following style indexes: equity long/short=LS, equity short selling=SHORT, equity market neutral=MN, event driven=ED, distressed securities=DIS, convertible arbitrage=CA, merger arbitrage=MA, emerging markets=EM, global macro=MACRO.

	FFM	SMB	HML	MOM	WRLD	ExUS	EM	BAA	USB	EMB	GB	CF	DY	PE	CO	PUT	CLL
BROAD	0.74 <b>6/6</b>	0.46 <b>6/6</b>	-0.47 <b>6/6</b>	0.09 <b>1/6</b>	0.68 <b>6/6</b>	0.64 <b>6/6</b>	0.76 <b>6/6</b>	0.20 <b>5/6</b>	0.06 <b>0/6</b>	0.56 <b>6/6</b>	-0.05 <b>0/6</b>	0.38 <b>6/6</b>	0.62 <b>6/6</b>	0.13 <b>2/6</b>	0.20 <b>6/6</b>	0.54 <b>6/6</b>	-0.60 <b>6/6</b>
LS	0.76 <b>7/7</b>	0.48 <b>7/7</b>	-0.50 <b>7/7</b>	0.10 <b>1/7</b>	0.69 <b>7/7</b>	0.66 <b>7/7</b>	0.69 <b>7/7</b>	0.15 <b>1/7</b>	0.06 <b>0/7</b>	0.56 <b>6/7</b>	-0.05 <b>0/7</b>	0.38 <b>6/7</b>	0.62 <b>6/7</b>	0.13 <b>2/7</b>	0.20 <b>6/7</b>	0.54 <b>6/7</b>	-0.60 <b>6/7</b>
SHORT	-0.63 <b>6/6</b>	-0.38 <b>6/6</b>	0.51 <b>5/6</b>	0.05 <b>0/6</b>	-0.56 <b>6/6</b>	-0.52 <b>6/6</b>	-0.45 <b>6/6</b>	-0.13 <b>3/6</b>	-0.04 <b>0/6</b>	-0.35 <b>6/6</b>	0.08 <b>0/6</b>	-0.50 <b>5/6</b>	-0.50 <b>6/6</b>	-0.08 <b>0/6</b>	-0.08 <b>0/6</b>	-0.30 <b>5/6</b>	-0.45 <b>6/6</b>
MKTN	0.31 <b>6/6</b>	0.21 <b>2/6</b>	-0.14 <b>2/6</b>	0.34 <b>5/6</b>	0.27 <b>5/6</b>	0.27 <b>6/6</b>	0.23 <b>4/6</b>	0.07 <b>0/6</b>	0.06 <b>0/6</b>	0.19 <b>4/6</b>	0.05 <b>0/6</b>	0.07 <b>0/6</b>	0.22 <b>4/6</b>	-0.02 <b>0/6</b>	0.15 <b>2/6</b>	0.19 <b>4/6</b>	-0.27 <b>6/6</b>
DIS	0.58 <b>7/7</b>	0.44 <b>7/7</b>	-0.25 <b>7/7</b>	-0.07 <b>0/7</b>	0.53 <b>7/7</b>	0.51 <b>7/7</b>	0.60 <b>7/7</b>	0.21 <b>7/7</b>	0.06 <b>0/7</b>	0.51 <b>7/7</b>	-0.11 <b>0/7</b>	0.16 <b>4/7</b>	0.47 <b>7/7</b>	0.00 <b>0/7</b>	0.07 <b>0/7</b>	0.46 <b>7/7</b>	-0.44 <b>7/7</b>
ED	0.72 <b>6/6</b>	0.44 <b>6/6</b>	-0.31 <b>6/6</b>	-0.07 <b>0/6</b>	0.67 <b>6/6</b>	0.63 <b>6/6</b>	0.70 <b>6/6</b>	0.19 <b>5/6</b>	0.03 <b>0/6</b>	0.55 <b>6/6</b>	-0.11 <b>0/6</b>	0.27 <b>6/6</b>	0.60 <b>6/6</b>	0.03 <b>0/6</b>	0.13 <b>0/6</b>	0.59 <b>6/6</b>	-0.56 <b>6/6</b>
MA	0.58 <b>6/6</b>	0.26 <b>6/6</b>	-0.15 <b>2/6</b>	-0.07 <b>0/6</b>	0.53 <b>6/6</b>	0.49 <b>6/6</b>	0.53 <b>6/6</b>	0.11 <b>0/6</b>	-0.03 <b>0/6</b>	0.44 <b>6/6</b>	-0.09 <b>0/6</b>	0.16 <b>2/6</b>	0.46 <b>6/6</b>	-0.01 <b>0/6</b>	0.12 <b>0/6</b>	0.59 <b>6/6</b>	-0.43 <b>6/6</b>
CA	0.28 <b>6/6</b>	0.21 <b>6/6</b>	-0.10 <b>0/6</b>	-0.07 <b>0/6</b>	0.25 <b>5/6</b>	0.22 <b>5/6</b>	0.27 <b>6/6</b>	0.20 <b>6/6</b>	0.12 <b>0/6</b>	0.25 <b>6/6</b>	-0.02 <b>0/6</b>	0.08 <b>0/6</b>	0.21 <b>6/6</b>	-0.05 <b>0/6</b>	0.02 <b>0/6</b>	0.19 <b>5/6</b>	-0.28 <b>6/6</b>
EM	0.67 <b>7/7</b>	0.35 <b>7/7</b>	-0.36 <b>7/7</b>	-0.02 <b>0/7</b>	0.64 <b>7/7</b>	0.60 <b>7/7</b>	0.85 <b>7/7</b>	0.15 <b>1/7</b>	0.02 <b>0/7</b>	0.66 <b>7/7</b>	-0.11 <b>0/7</b>	0.29 <b>7/7</b>	0.60 <b>7/7</b>	0.04 <b>0/7</b>	0.15 <b>1/7</b>	0.49 <b>7/7</b>	-0.55 <b>7/7</b>
MACRO	0.46 <b>7/7</b>	0.33 <b>6/7</b>	-0.29 <b>6/7</b>	0.19 <b>5/7</b>	0.42 <b>6/7</b>	0.39 <b>6/7</b>	0.51 <b>7/7</b>	0.25 <b>7/7</b>	0.21 <b>6/7</b>	0.36 <b>7/7</b>	0.16 <b>4/7</b>	0.17 <b>2/7</b>	0.33 <b>6/7</b>	0.00 <b>0/7</b>	0.19 <b>5/7</b>	0.29 <b>6/7</b>	-0.41 <b>7/7</b>



for elementary strategies that are based on firm-specific data I consider the traditional Fama French factors for size and book-to-market equity. Additionally, I construct factors based on price earnings ratios, cash-flow ratios and dividend yields. The later three strategies buy assets with high past price-earning ratios, cash-flows and dividend yields while selling assets with low values in these characteristics. Following Carhart (1997), I also consider a momentum strategy that chooses past winners while selling past losers. Data of the MSCI indexes are obtained from Datastream, the other data can be downloaded from the webpage of Kenneth French, Dartmouth College.<sup>14</sup>

Factor strategies that do not invest in equities are mimicked by the excess returns of the S&P Commodity index and the excess returns of the following bond indexes: Lehman US Aggregate, Lehman BAA Corporate bond, Lehman Global Bond index and the JP Morgan Emerging Markets Bond index. Excess returns are – as for the broad equity strategies – calculated with respect to the 1 month US treasury bill rate.

Following Agarwal and Naik (2004) I also consider factor strategies that incorporate investments in options.<sup>15</sup> I use the excess returns of two option-strategies published by the Chicago Board Options Exchange (CBOE). The first strategy writes a sequence of put options on the S&P 500 (PUT) while investing cash at the one-month and three-month treasury rate. The amount of cash resembles the maximal possible loss of the short put position.<sup>16</sup> The second strategy is the so-called CBOE S&P 500 Collar Index (CLL). The CLL reflects a strategy holding stocks in the S&P 500 index, buying three-month S&P 500 put options for protection and selling one-month S&P 500 call options to help finance the cost of the put options.<sup>17</sup>

To get an impression how these factor strategies are correlated with the HF styles I calculate the average linear correlation of each style with the different factor strategies. For each strategy I also denote the fraction of indexes that exhibit significant non-zero correlation. The results are reported in Table 3. Note that the fraction of non-zero correlation coefficients is usually 0 or 1. Therefore, either all competing indexes are correlated or none. Such a result implies consistency in the sense that all competing indexes exclusively share the characteristics of the same factor strategies. Inconsistency, on the other hand, is expressed when some competing indexes have significant exposure while other indexes are not significantly correlated. The least consistent results are obtained for the market neutral and global macro strategies, indicating that these strategies are not well-defined across providers.

The results of Table 3 also provide a first glimpse in the investment preferences of the HF managers. I find that HFs are usually correlated with broad equity factors such as the Fama French market factor (FFM), the MSCI ex US (ExUS), the MSCI World index (WRLD) and the MSCI emerging market

<sup>14</sup><http://mba.tuck.dartmouth.edu/pages/faculty/ken.french>

<sup>15</sup>Agarwal and Naik (2004) build their approach on Glosten and Jagannathan's (1994) contingent claim framework.

<sup>16</sup>See <http://www.cboe.com/micro/put> for details.

<sup>17</sup>See <http://www.cboe.com/micro/coll/introduction.aspx> for details.

(EM) index. The FFM, proxying for investments in the US market, usually exhibits the highest average coefficient, indicating that HF preferably invest in US equities. In terms of bond strategies, the emerging markets bond strategy factor (EMB) is clearly predominant. When choosing to invest in US bonds, HF usually focus on low rated bonds (BAA). Exposure to commodities (CO) is only visible for the global macro strategy. This low exposure to commodities is no surprise as most index providers separately cover funds with a special focus on trading in commodity futures, the so-called commodity trading advisors (CTAs). I do not cover CTAs but refer to Fund and Hsieh (1997a).

## Main results

The number of dominant factors is the primary indicator for consistency across providers. The existence of dominant factors suggests that the competing indexes reflect a set of HFs that follow similar basic strategies. The results in Table 4 show a high degree of homogeneity across providers. Most strategies exhibit three or four dominant factors – the market neutral strategy is the only style with two dominant factors. Moreover, exposure to these factors is usually within a close range, and in several cases equality of parameters cannot be rejected. I continue the discussion by individually considering the results for the different indexes.

### Broad index

A broad HF index is a potpourri of all different styles. It is therefore plausible that the dominant factors of the broad indexes are the factor strategies that most often appear as dominant factors for the individual styles, these are, the Fama French size factor (SMB), the momentum factor (MOM) and the emerging markets factor (EM). Positive loadings on these factors indicate that HF managers preferably hold small companies, follow momentum strategies and often invest in emerging markets.<sup>18</sup> All providers agree on these three factors. This finding indicates that, as a whole, the different index providers present a homogeneous picture of the HF industry. The exposures to the dominant factors are within the same range for all indexes, however, equality has to be rejected for all parameters.

Recall that Credit-Suisse/Tremont is the only provider that applies a capital weighted scheme which allocates more weight to larger funds. This difference manifests in a considerable lower value for  $R^2$ , denoting that large and small HFs invest differently. Further, the Credit-Suisse/Tremont index has the lowest alpha which suggests that small HFs tend to provide a better risk-adjusted performance.<sup>19</sup>

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<sup>18</sup>Capoccia and Hübner (2002) report a similar result for their study using HF data from January 1994-June 2000.

<sup>19</sup>Ammann and Moehrt (2008) also reveal a significantly negative relationship between fund performance and fund size.

## Equity long short

The result for the equity long/short style shows a high degree of consistency, apart from the Altvest index. While all other indexes agree on the Fama French market (FFM) and size (SMB) factors, on the momentum factor (MOM) and on investments in emerging markets (EM), the Altvest index prefers the Fama French value factor (HML) to the MOM. As a result, the  $R^2$  of the dominant factor model is considerable lower for the Altvest index than for the indexes of the other providers.

Additionally, the loading of the Altvest index on US equity (FFM) is significantly lower than for any other provider which indicates that Altvest interprets the long/short style differently in terms of net market exposure. However, less net exposure to equity markets is not per se questionable as the other indexes report exposure to US equity which is between 0.3 and 0.4. I consider these numbers to be rather high for a mixed long/short strategy. Finally, equity long/short managers also invest in emerging markets (EM), and I find that equality of exposure to EM cannot be rejected at the 5% significance level.

## Short selling

For the short selling style I find three factor strategies for which all but one providers agree on. Again, the Altvest index is an outlier – not in terms of dominant strategies but in terms of exposure to these strategies. I first discuss the results for the other providers. I find that HF pursuing a short selling style have strong negative exposure to US equities (FFM) and tend to hold short positions in small companies (SMB). Additionally, the indexes have positive loadings on the PutWrite strategy (PUT) which sells put options on the S&P 500. Hence the managers hedge their short positions in equities by similiarly holding short positions in put option. In rising markets, for example, it is expensive to settle the short position in equities. At the same time, the value of the shortened put options decreases which covers the HF manager against extreme losses.

For all factor strategies the Altvest index shows opposite signs in its exposures. This finding helps explain the previous results for the equity long/short style. Recall that the Altvest equity long/short index has less exposure to FFM than its peers. Together with the finding that the Altvest short selling index has positive exposure to FFM, I conclude that Altvest allocates the funds differently to these strategies, assigning funds that other providers consider as equity long/short funds to the short selling style and vice versa.

The fact that there are three dominant factors for the short selling style indicates that the different indexes reflect HFs with similiar investment behavior. Moreover, in all cases but for the Altvest strategies the exposures to these factors have the same sign and tend to be in the same range. However, even when excluding the Altvest index equality of the parameters has to be rejected.

Table 4: **Dominant factors.** This table shows the dominant factors for the broad HF indexes and the nine HF styles in consideration. The factor strategies which appear as dominant factors are: the Fama French market factor (FFM), the Fama French size factor (SMB), the Carhart momentum factor (MOM), the MSCI emerging markets index (EM), the JP Morgan emerging markets bond index (EMB), the cash-flow factor (CF), the JP Morgan Global bond index (GB), and the CBOE strategies PutWrite (PUT) and Collar (CLL). Further, exposure to these factors, the alpha and the explanatory power of the dominant model ( $R^2$ ) are printed. I also denote for how many competing indexes a factor strategy appears in the four factor model exhibiting the highest  $R^2$  (best choice for). If a parameter is *not* significantly different from zero at the 1% level, it is shown in bold type. *\*\*\*/\*\*/\** indicates that equality of factor exposure *cannot* be rejected at the 10%/5%/1% level. Example: for the equity long/short strategy, equality of exposure to EM cannot be rejected at the 5% level.

broad index	alpha	SMB	MOM	EM	n/a	$R^2$
Credit-Suisse/Tremont	<b>0.24</b>	0.09	0.13	0.17		0.53
Hedge Fund Research	0.25	0.14	0.04	0.23		0.77
CISDM	0.37	0.15	0.05	0.23		0.75
Barclay Hedge	0.0043	0.12	0.05	0.22		0.73
Greenwich	<b>0.0021</b>	0.09	0.06	0.25		0.77
Hedge Fund Net	0.0056	0.09	0.05	0.17		0.67
best choice for:		7/7	7/7	7/7		
equity long/short	alpha	FFM	SMB	MOM	EM**	$R^2$
Credit-Suisse/Tremont	<b>0.21</b>	0.41	0.19	0.23	0.07	0.81
Hedge Fund Research	0.32	0.39	0.19	0.10	0.07	0.84
CISDM	0.25	0.34	0.14	0.08	0.07	0.82
Altvest	0.41	0.11	<b>0.03</b>	<b>0.03</b>	0.09	0.54
Barclay Hedge	0.46	0.32	0.17	0.09	0.06	0.77
Greenwich	0.39	0.40	0.22	0.08	0.06	0.84
Hedge Fund Net	0.57	0.35	0.18	0.11	0.08	0.81
best choice for:		7/7	7/7	6/7	7/7	
short selling	alpha	FFM	SMB	PUT	n/a	$R^2$
Credit-Suisse/Tremont	<b>0.14</b>	-1.15	-0.23	0.35		0.78
Hedge Fund Reseach	0.56	-1.21	-0.52	0.49		0.84
Altvest	<b>0.41</b>	0.38	<b>0.08</b>	<b>-0.20</b>		0.25
Barclay Hedge	0.70	-1.05	-0.50	0.42		0.89
Greenwich	<b>0.35</b>	-1.22	-0.48	0.43		0.82
Hedge Fund Net	0.57	-0.89	-0.30	0.26		0.89
best choice for:		6/7	6/7	6/7		

equity market neutral	alpha	FFM*	MOM	n/a	n/a	$R^2$
Credit-Suisse/Tremont	0.50	0.06	<b>0.00</b>			0.16
Hedge Fund Research	0.14	0.06	0.09			0.39
CISDM	0.31	0.07	0.03			0.32
Barclay Hedge	0.19	0.08	0.11			0.46
Greenwich	0.41	0.12	0.10			0.36
Hedge Fund Net	0.31	0.07	0.08			0.46
best choice for:		5/6	5/6			
distressed securities	alpha*	FFM***	SMB	EMB	CF*	$R^2$
Credit-Suisse/Tremont	0.25	0.22	0.10	0.14	-0.22	0.47
Hedge Fund Research	0.16	0.22	0.15	0.10	-0.29	0.54
CISDM	0.18	0.21	0.15	0.10	-0.25	0.60
Altvest	0.32	0.23	0.17	<b>0.07</b>	-0.23	0.57
Barclay Hedge	0.22	0.22	0.16	0.09	-0.29	0.54
Greenwich	0.33	0.19	0.15	<b>0.04</b>	-0.22	0.49
Hedge Fund Net	0.16	0.22	0.19	0.14	-0.25	
best choice for:		7/7	7/7	6/7	6/7	
event driven	alpha***	FFM	SMB	EM	CF*	$R^2$
Credit-Suisse/Tremont	0.28	0.18	0.09	0.09	-0.21	0.55
Hedge Fund Research	0.26	0.28	0.17	0.06	-0.20	0.78
CISDM	0.28	0.28	0.11	<b>0.04</b>	-0.25	0.74
Barclay Hedge	0.30	0.29	0.13	0.08	-0.27	0.74
Greenwich	0.31	0.26	0.20	<b>0.02</b>	-0.20	0.72
Hedge Fund Net	0.27	0.28	0.14	0.05	-0.23	0.74
best choice for:		7/7	7/7	6/7	6/7	
merger arbitrage	alpha	SMB	CF***	PUT	n/a	$R^2$
Credit-Suisse/Tremont	0.23	0.08	-0.09	0.27		0.49
Hedge Fund Research	0.24	0.09	-0.08	0.23		0.46
Altvest	0.36	0.07	-0.08	0.27		0.40
Barclay Hedge	0.36	0.06	-0.08	0.23		0.43
Greenwich	0.28	0.05	-0.06	0.21		0.37
Hedge Fund Net	0.32	0.05	-0.07	0.24		0.40
best choice for:		6/6	5/6	5/6		
convertible arbitrage	alpha	SMB***	BAA***	CLL*	n/a	$R^2$
Credit-Suisse/Tremont	0.36	0.07	0.17	-0.07		0.09
Hedge Fund Research	0.33	0.06	0.14	-0.09		0.16
CISDM	0.37	0.06	0.09	-0.07		0.16
Barclay Hedge	0.36	0.07	0.13	-0.09		0.16
Greenwich	0.43	0.07	0.12	-0.09		0.15
Hedge Fund Net	0.42	0.07	0.12	-0.10		0.18
best choice for:		6/6	6/6	6/6		

emerging markets	alpha	EM	EMB	PUT	n/a	$R^2$
Credit-Suisse/Tremont	<b>-0.12</b>	0.44	0.41	-0.34		0.74
Hedge Fund Research	<b>0.11</b>	0.52	0.25	-0.23		0.83
CISDM	<b>-0.10</b>	0.41	0.31	-0.21		0.75
Altvest	0.48	0.23	<b>0.03</b>	<b>0.00</b>		0.65
Barclay Hedge	<b>0.25</b>	0.52	0.26	-0.22		0.81
Greenwich	<b>0.04</b>	0.63	0.27	-0.33		0.82
Hedge Fund Net	0.51	0.45	0.27	-0.23		0.73
best choice for:		7/7	7/7	6/7		
global macro	alpha	MOM	EM	GB***	n/a	$R^2$
Credit-Suisse/Tremont	0.59	0.13	0.11	0.32		0.15
Hedge Fund Research	0.29	0.11	0.17	0.25		0.44
CISDM	0.34	0.10	0.16	0.25		0.46
Altvest	0.23	0.05	0.12	0.22		0.44
Barclay Hedge	0.30	0.10	0.22	0.22		0.53
Greenwich	0.37	0.11	0.18	0.26		0.50
Hedge Fund Net	0.02	0.14	0.23	0.22		0.40
best choice for:		7/7	6/7	6/7		

## Equity market neutral

HFs following a market neutral style aim to generate returns without exhibiting exposure to the market factors. Such an investment objective obviously hampers the procedure used in the present paper as I explicitly look for common market exposure or exposure to macro risk factors. It is therefore not surprising that the results for the market neutral style show the least amount of consistency across providers. I only find two dominant factors on which all competing indexes agree: US equity (FFM) and the momentum factor (MOM). Equality for exposure to FFM cannot be rejected.

The Credit-Suisse/Tremont index is a clear outlier with a  $R^2$  value of only 0.16 while for the competing indexes around 30%-40% of the variation can be explained using these two factors. I do not interpret this finding as evidence for a substantial difference in the behavior of large and small funds. I rather conjecture that Credit-Suisse/Tremont allocates the funds differently between the market neutral style and the equity long/short style. Evidence for this notion is provided by the exposure to the MOM: while the Credit-Suisse/Tremont market neutral index has no exposure to the MOM, the Credit-Suisse/Tremont long/short index has a considerably larger exposure to the MOM than the long/short indexes of the other providers.

## Distressed securities

The result for the distressed securities style presents a homogenous image. I find four dominant factors: US equities (FFM), the Fama French size factor (SMB), the emerging markets bond factor (EMB) and the cash-flow factor (CF).

Equality of exposure to FFM, respectively CF, cannot be rejected at the 10%, respectively 1%, level. Homogeneity also expressed in the alphas.

The exposure to the SMB factor is no surprise as smaller companies are more likely to be in financial distress. The negative exposure to the CF shows that the HFs tend to hold long positions in companies that produce high cash flows. The exposure to the EMB shows that HF also invest in emerging markets. I conclude that the exposure to the emerging markets bond factor, rather than the emerging markets equity factor, is a result of the special focus on companies in financial distress. A possible source for high returns of the EMB is an increasing default risk for emerging market loans which indicates that companies face stronger financial distress. In such a market environment the HFs following a distressed style tend to generate higher profits as there are more investment opportunities.

## **Even driven**

The dominant factor model for the event driven style strongly resembles the results for the distressed securities style. This finding is plausible as the distressed securities style is often treated as a subcategory of the even driven style. Event driven managers also have exposure to US equities (FFM) and exhibit a special focus on small companies (SMB) and companies that generate high cash-flows (CF). Equality for exposure to CF and equality in the alphas cannot be rejected. Further, event driven funds also invest in emerging markets (EM). Though, investments in emerging markets are characterized by general equity exposure rather than exposure to emerging markets bonds. This finding is in accordance with the event driven style definition which states that ED funds do not exclusively invest in companies that are in financial stress but look for opportunities triggered by different sorts of events. This subtle difference between these two styles is well captured by all index providers.

## **Merger arbitrage**

Merger arbitrage funds exploit mispricings of companies that are in the process of a merger: typically, the company being acquired is bought while stocks in the acquirer are sold. My results indicate that merger arbitrage funds tend to buy small companies (SMB) and companies with high cash-flows (CF). Equality of factor loadings on the CF cannot be rejected at the 5% level. Further, exposure to the PutWrite strategy (PUT) shows that the returns of the merger arbitrage funds resemble the returns of a short position in put options. A similar result is reported by Agarwal and Naik (2004) for the HFR event arbitrage index. I briefly repeat their argument as it nicely explains this relationship. Merger arbitrage funds tend to generate profits when mergers are successfully concluded. More mergers go through in up markets, in down markets the merger arbitrage strategy loses money. Such a payoff profile also emerges from selling a put option. Further, a successful merger does not depend on the extent of the up-movement of the market, similarly, the profit from selling a put does not

depend on the extent on the up-movement (once the option's strike price is exceeded).

## Convertible arbitrage

I find that HF managers following convertible arbitrage strategies have positive loadings on the Fama French size factor (SMB) and on low rated US bonds (BAA). I interpret this finding as evidence that HF managers usually find mispricings for convertible bonds emitted by smaller companies and companies that face large default risk. Additionally, I find negative exposure to the collar strategy (CLL), indicating that this strategy has an explicit non-linear payoff structure. The loadings on the dominant factors are very consistent across providers. Equality for exposure to neither factor can be rejected. Also, a joint test of similar exposure to each factor cannot be rejected at the 5% level. I conclude that convertible arbitrage is a narrowly defined style.

However, the low values for the adjusted  $R^2$  show that only a small fraction of variation can be captured by the factor strategies in consideration. Further, the  $R^2$  of the Credit-Suisse Tremont index is considerably lower than for other strategies, suggesting that large funds following convertible arbitrage strategies exhibit different risk exposures than small funds.

## Emerging markets

In accordance with the strategy definition the emerging markets funds show significant exposure to emerging market equities (EM) and bonds (EMB). The PutWrite strategy (PUT) is a third dominant factor. The exposure to the PUT might seem puzzling as it sells put options on the S&P 500 and not on emerging markets equities. However, knowing that many emerging markets neither allow short selling nor offer viable derivative products this exposure indicates that HF managers switch to derivative products offered by developed markets to protect their investments.

Equality for all parameters is rejected at high levels. The rejection is primarily due to the different exposures of the Altvest index which exhibits significantly lower exposure to both EM and EMB. In terms of alpha the emerging markets funds are the worst performers. In two cases the alpha is negative (although not significantly) and only in two cases the HF index significantly outperforms the factor model.

## Global macro

Global macro aims to profit from changes in the global economy. The exact nature of the investment (e.g. the asset class), however, is not well-defined. Despite this vague definition the different providers show a high degree of consistency. They agree on three dominant factors: the momentum strategy (MOM), the emerging markets strategy (EM) and the global bond strategy (GB). Equality of exposure to the GB factor cannot be rejected at the 10% level. As for the



convertible arbitrage and the market neutral strategies there is a considerable difference between large and small capitalized funds, expressed in a lower  $R^2$  value for the Credit-Suisse Tremont index.

## Robustness

I test the robustness of the results in two ways. First, I divide the sample period in two sub periods and look for dominant factors in each of these sub periods. Second, I examine if and how the results change when not considering the best four factor model in terms of  $R^2$  but the second best combination.

### Two subperiods

I test for consistency in two sub-periods of similar lengths. Subperiod 1 (S1): January 1997 to December 2002. Subperiod 2 (S2): January 2003 to July 2008. I proceed similar to the discussion of the whole sample period, that is, for each index I choose all possible four factor combinations and choose the model that exhibits the highest  $R^2$ . To account for the fact that divergences more likely appear in smaller periods I lower the requirement for dominance. I consider a factor strategy to be dominant if it is part of the best four factor model of at least all but two providers. Other than that, everything remains the same.

The results in Table 5 show that the number of dominant factors is comparable to considering the whole sample period. I find three or more dominant factor strategies for most styles – however, some strategies profit from the loosened restrictions. Further, I find that equality of exposure to several factor strategies cannot be rejected.

It is interesting to see that the dominant factors for a specific style often differ in the two sub periods. A closer look reveals two different investment focuses. In the first period, investments in US equities are predominant. Note that the Fama French factor (FFM) proxying for investment in US equities appears in six out of ten cases. For the second subperiod, on the other hand, there is a strong tendency for investments in non US equity (ExUS) and emerging markets (EM and EMB). The FFM now only appears in the best model for the short selling and merger arbitrage style.

### The second best combination

Recall that a dominant strategy for a HF style appears in the best (in terms of  $R^2$ ) four factor model of at least all but one index providers. To test for robustness of the results I examine how often a dominant strategy appears when considering the factor models exhibiting the second highest  $R^2$ . I claim that any dominant factor having economic also needs to appear in these factor models – dominant factors without economic content are replaced by other strategies.

**Table 5: Dominant factors when considering two sample periods.** The table depicts the dominant factor strategies for two sub periods. Subperiod 1 (S1): January 1997 - December 2002. Subperiod 2 (S2): January 2003 - July 2008. I lower the requirement for a factor strategy to be dominant to appearance in all but two factor models. Moreover, I denote the median factor loading (med  $\beta$ ) for each factor strategy. The factor strategies which appear as dominant factors are: the Fama French market factor (FFM), the Fama French size factor (SMB), the Fama French value factor (HML), the Carhart momentum factor (MOM), the cash-flow factor, the dividend yield factor (DY). Further, dominant factors are the excess returns of the following indexes: the MSCI World TR index (WD), the MSCI World TR index excluding US equities (xUS), the MSCI emerging markets index (EM), the Lehman Corporate bond index (CB), the Lehman BAA bonds index (BAA), the JP Morgan Global bond index (GB), the JP Morgan emerging markets bond index (EMB) and the CBOE indexes PutWrite (PUT) and Collar (CLL). If equality of exposures to a factor strategy cannot be rejected at the 10%/5%/1% level it is denoted by \*\*\*/\*\*/\*.

Jan 1997 - Dec 2002					Jan 2003 - Jul 2008			
br	FFM	SMB	MOM	EM	ExUS*	EM*	CF**	DY***
best	5/6	6/6	6/6	6/6	6/6	6/6	5/6	5/6
med $\beta$ :	0.24	0.11	0.06	0.10	0.14	0.14	-0.17	0.16
LS	FFM	SMB	MOM	n/a	SMB	EM	DY***	n/a
best	7/7	7/7	6/7		5/7	7/7	6/7	
med $\beta$ :	0.43	0.22	0.08		0.14	0.24	0.22	
SHORT	FFM	SMB	MOM	n/a	FFM	SMB	n/a	n/a
best	5/6	5/6	4/6		5/6	5/6		
med $\beta$ :	-0.88	-0.39	-0.09		-0.77	-0.26		
MN	FFM	MOM**	EM	PE	MOM	ExUS*	CF	DY
best	6/6	4/6	4/6	5/6	4/6	4/6	5/6	4/6
med $\beta$ :	0.82	0.08	-0.02	-0.03	0.06	0.08	-0.15	0.08
DIS	FFM***	SMB	EMB	CF***	SMB	CF**	n/a	n/a
best	6/7	7/7	5/7	6/7	6/7	7/7		
med $\beta$ :	0.17	0.15	0.12	-0.20	0.25	-0.14		
ED	FFM	SMB	HML	n/a	SMB	EM	CF	n/a
best	6/6	6/6	4/6		5/6	4/6	6/6	
med $\beta$ :	0.30	0.19	0.16		0.16	0.07	-0.21	
CA	SMB***	CLL***	n/a	n/a	exUS	BAA**	GB**	n/a
best	6/6	6/6			5/6	6/6	5/6	
med $\beta$ :	0.07	-0.08			0.08	0.40	-0.30	
MA	SMB*	EMB***	PUT*	n/a	FFM***	WD***	xUS*	CF
best	5/6	5/6	5/6		6/6	4/6	4/6	6/6
med $\beta$ :	0.04	0.06	0.16		0.28	-0.26	0.21	-0.16
EM	mom*	em	DY***	n/a	ExUS**	EM	n/a	n/a
best	7/7	7/7	6/7		5/7	7/7		
med $\beta$ :	0.15	0.52	0.25		0.07	0.37		
MO	MOM	GB	CLL	n.a.	EM	CB**	COM	n.a.
best	7/7	5/7	5/7		7/7	6/7	6/7	
med $\beta$ :	0.10	0.18	-0.27		0.15	0.20	0.06	

**Table 6: Second best combination.** This table shows for how many providers the dominant factors appear in the second best (in term of  $R^2$ ) four factor model. For convenience, I repeat the results for the best model. The factor strategies which appear as dominant factors are: the Fama French market factor (FFM), the Fama French size factor (SMB), the Carhart momentum factor (MOM), the MSCI emerging markets index (EM), the JP Morgan emerging markets bond index (EMB), the cash-flow factor (CF), the JP Morgan Global bond index (GB), and the CBOE indexes PutWrite (PUT) and Collar (CLL). As an example consider the equity long/short strategy. This stratey exhibits four dominant strategies: FFM, SMB, MOM and EM. These dominant strategies appear in the best four factor model of seven (FFM, SMB, EM) or six (MOM) providers. When considering the second best model FFM, SMB and MOM still appear. The EM factor, however, is replaced.

broad index	SMB	MOM	EM	n/a
best model	6/6	6/6	6/6	
2nd best model	6/6	4/6	6/6	
equity long/short	FF	SMB	MOM	EM
best model	7/7	7/7	6/7	7/7
2nd best model	6/7	7/7	6/7	1/7
short selling	FMKT	SMB	PUT	n/a
best model	5/6	5/6	5/6	
2nd best model	5/6	5/6	4/6	
market neutral	FFMKT	MOM	n/a	n/a
best model	5/6	5/6		
2nd best model	4/6	5/6		
distressed	FMKT	SMB	EMB	CF
best model	7/7	7/7	6/7	7/7
2nd best model	5/7	7/7	2/7	6/7
event driven	FFM	SMB	EM	CF
best model	6/6	6/6	5/6	5/6
2nd best model	6/6	6/6	1/6	5/6
convertible arbitrage	SMB	BAA	CLL	n/a
best model	6/6	6/6	5/6	
2nd best model	5/6	5/6	5/6	
merger arbitrage	SMB	CF	PUT	n/a
best model	6/6	5/6	6/6	
2nd best model	5/6	4/6	4/6	
emerging markets	EM	EMB	PUT	n/a
best model	7/7	6/7	6/7	
2nd best model	7/7	6/7	5/7	
global macro	MOM	EM	GB	n/a
best model	7/7	6/7	6/7	
2nd best model	6/7	5/7	4/7	

I start by considering the styles that exhibit two or three dominant factors. The result depicted in Table 6 show that the dominant factors also tend to appear in the second best model. I conclude that the dominant factors capture the variation of the HF styles that can be explained by using the available factor strategies, that is, the non-dominant factors do not add explanatory power and are therefore replaced while the dominant factors remain.

When considering the models with four dominant factors the situation is obviously different as not all factors can simultaneously appear in the best and the second best model. I figure two possible scenarios. First, if all four strategies have similar explanatory power, then they will also predominantly appear in the second best model, that is, there is no factor which is replaced in most cases. In the second scenario one dominant factor has significantly less explanatory power, and it will be exchanged while the other factors maintain their significance in jointly explaining the returns.

The results clearly support the later scenario. In all three cases one factor is less often represented in the second best model, and in all three cases it is a factor representing investments in emerging markets: the emerging markets equity index (EM) for the event driven and equity long/short styles, the emerging market bond index (EMB) for the distressed securities style. Recall from the first robustness test that the investment focus switches from US equities to emerging markets. This change hampers the explanatory power of factor strategies focussing on a geographical region as they only represent investment behavior for a sub period. I interpret the fact that emerging markets strategies are predominantly replaced as evidence that HF – when considering the whole sample period – typically invest in US equities.

## Concluding remarks

In the present study I examine the consistency of HF indexes published by several data providers. I define and employ a procedure which is based on the assumption that a HF style can be disassembled into a typical linear model consisting of at most four so-called factor strategies. A factor strategy is a zero-investment portfolio that proxies for investments in an asset class of geographical region. To evaluate the typical model for a HF style, I assemble all possible four factor models from a pool of 17 factor strategies. I examine which combination yields the best result in terms of  $R^2$  for each competing index, and I test if these models have similar components. I consider a factor strategy to be dominant if it appears in the best factor model for the style index of at least all but one provider. The results show that the competing indexes present a homogeneous image in the sense that I find three or four dominant factors for all but one styles. The only exception is the market neutral style with two dominant factors.

The results also allow some insight in HF managers' investment preferences. Consistent with the results of Capocci and Hübner (2002), I find that HF managers preferably invest in small capitalized companies, often follow a momentum strategy and invest in emerging markets. As reported in Agrawal and Naik

(2004), I also find that factor strategies which are based on the use of options help explain the return characteristics of merger arbitrage and convertible arbitrage funds. Further, I consider a factor strategy which is constructed based on past cash-flows. Such a factor strategy has yet been used to analyse HF returns, and I find that it is relevant for the event driven style and its sub categories distressed securities and merger arbitrage. HF managers following these styles typically hold companies generating high cash-flows.

I stress that the dominant factor models are not intent to replicate the exact behavior of the HFs but merely represent average exposures for the period under consideration. The robustness tests show that the dominant models considerably differ in some cases between sub periods and also between either sub period and the whole sample period. This result is obviously due to the fact that HF managers can and usually do rebalance their investments. A possible extension of the testing procedure is thereby given by models who account for the fact that exposure to factor strategies can vary over time. Such models are referred to as *conditional models* as they allow the parameters to vary *conditionally* on the values of so-called instruments.<sup>20</sup> An instrument is a macroeconomic variable that proxies for overall market condition. The spread between a ten-year and a one-year Treasury bond yield (*term spread*) is one possible instrument since several studies<sup>21</sup> show that future stock and bond returns vary with the term spread. The use of conditional models to compare the competing indexes adds another dimension to the discussion as the results not only rely on the factor strategies but also on the information set exploited by the HF managers, providing thereby more detailed information about their investment behavior.

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<sup>20</sup>I refer to Ferson and Harvey (1999) for a study using conditional models to explain stock returns.

<sup>21</sup>See, e.g., Fama and French (1989).

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## Appendix: Style definition

I briefly define the HF styles considered in this study. These style definitions are extracted from the definitions given on the webpages of the providers. I usually rely on the definition of Barclay Hedge (<http://www.barclayhedge.com>).

### Equity long short

Hedge funds following an equity long short style can hold both long and short positions. Usually a net long or short bias is obtained, market neutrality is not the main objective. Return enhancing and hedging using options is possible.

### Short selling

Hedge funds following a short selling style hold a net short bias in equities and derivatives. Short selling manager outperform the market mainly during down movements.

### Market neutral

Hedge funds following a market neutral style hold long and short positions of equal size, resulting in a zero-beta portfolio to either a broad market index or other factors. Leveraging is usually applied for return enhancing.

**Event driven**

Hedge funds following an event driven style focus on mispricings of companies that are involved in a significant corporate action such as a restructuring, merger, bankruptcy or reorganization.

**Distressed securities**

Hedge funds following a distressed securities style invest in companies that trade at a significant discount due to financial distress. Distressed securities is usually a subcategory of the event driven style.

**Merger arbitrage**

Hedge funds following a merger arbitrage style exploit mispricings of companies that are in the process of a merger: typically, the company being acquired is bought while stocks in the acquirer are sold.

**Convertible arbitrage**

Hedge funds following a convertible arbitrage style exploit mispricings of convertible securities: typically, a long position in the convertible bond of a company is held while simultaneously selling stocks in the company.

**Emerging markets**

Hedge funds following a emerging markets style invest in equity or fixed income instruments in emerging markets.

**Global macro**

Hedge funds following a global macro style base their investment decisions on their views on overall market direction. They are neither restricted to a specific asset class nor market.